DOE's Coal Technology Demonstration Programs: CCT, PPII & CCPI

Evolution of Combustion Technology to Support National Energy Needs

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DOE Coal Technology Demonstration Programs

- **Clean Coal Technology (CCT) Program**
  - 1986-1993 Project Selections (38 total, 7 active)
  - $1.75 B DOE + $3.45 B Participants
- **Power Plant Improvement Initiative (PPII)**
  - 2001 Project Selections (8 active)
  - $51 MM DOE + $61 MM Participants
- **Clean Coal Power Initiative (CCPI)**
  - 2003-2011 Project Selections
  - $2 B DOE + $2 B (or more) Participants

Clean Coal Technology Program
Success Stories

- **Scrubbers for SO_2 Control**
- **NO_x Control Technologies**
  - Low-NO_x burners, over-fire air & advanced controls
  - Coal & gas reburning
  - SNCR & SCR
- **HAPS & Hg Data**
- **FBC & IGCC Demonstrations**

Healy Clean Coal Project

- 50 MWe (nominal) power plant in Healy, AK
- $242.1 MM total cost; $117.3 MM DOE share
- TRW slagging combustors; B&W activated recycle SDA
- 97% plant availability during 90-day test
- Final Report in preparation

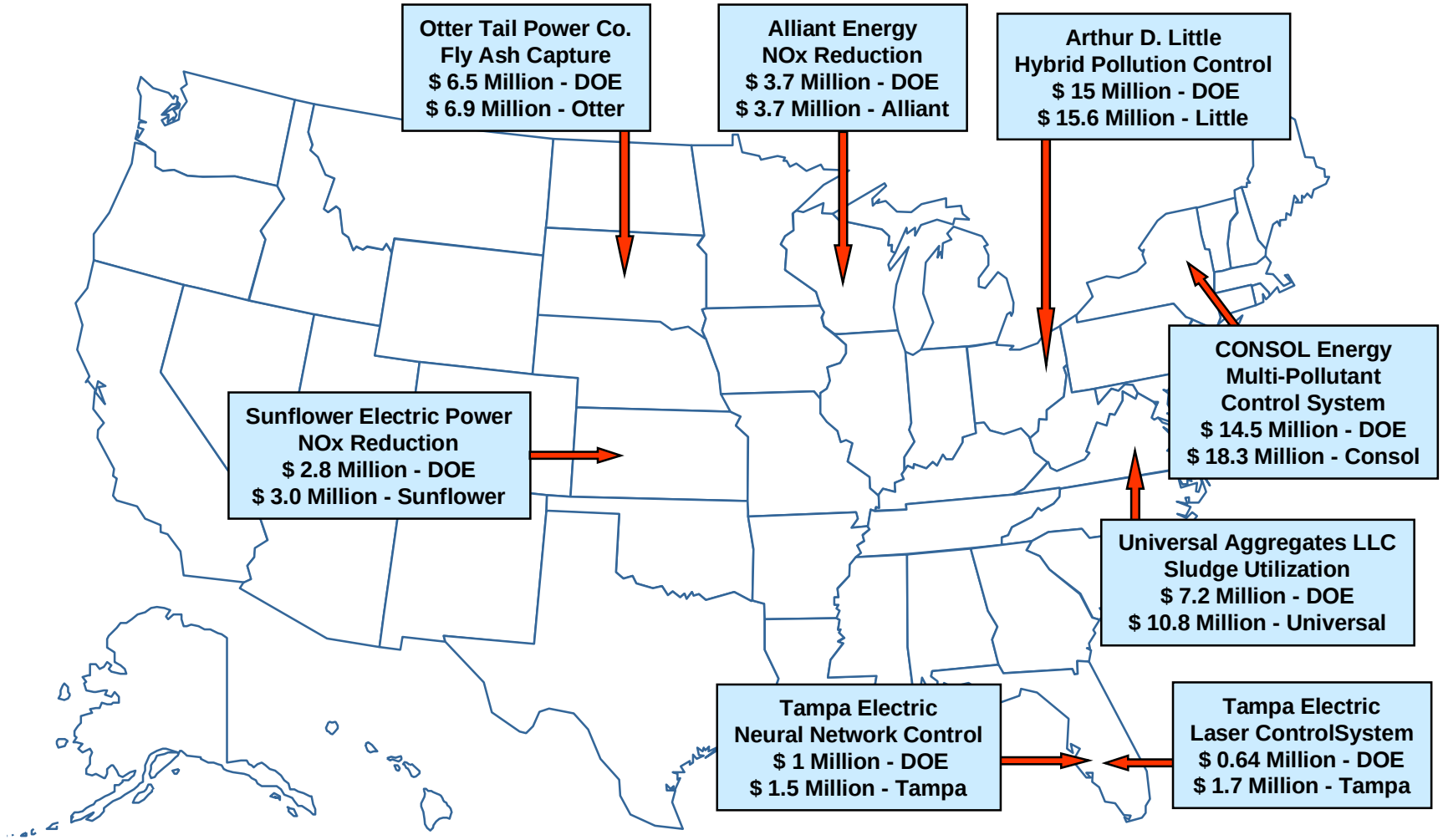
JEA CFB Demonstration Project

- 297.5 MWe gross (265 MWe net) Foster Wheeler ACFB
- JEA's Northside Station, Jacksonville, FL
- $309.1 MM total cost; $74.7 MM DOE share
- 90% SO_2 removal + 60% NO_x reduction
- Operations from May 2002-May 2004

Lakeland CCT Project

- 240 MWe (net) Foster Wheeler PCFB
- McIntosh Station, Lakeland, FL
- $219.6 MM total cost; $109.6 MM DOE share
- Restructuring

Power Plant Improvement Initiative (PPII)



PPII Project Summary

	NO_x	SO_2	Hg, PM, or Acid Gas	By-Prod. Utiliz.	Effic. Improv.	Gasif. Improv.
Alliant	X				X	
AD Little	X					
CONSOL	X	X	X			
Otter Tail			X			
Sun-flower	X				X	
Tampa BBend	X				X	
Tampa Polk						X
Univ. Agg.				X		

Combustion Initiative for Innovative Cost-Effective NO_x Reduction

Participant: Alliant Energy Corp. (Wisc. P&L)

Team Members: EPRI, Reaction Eng'g Int'l

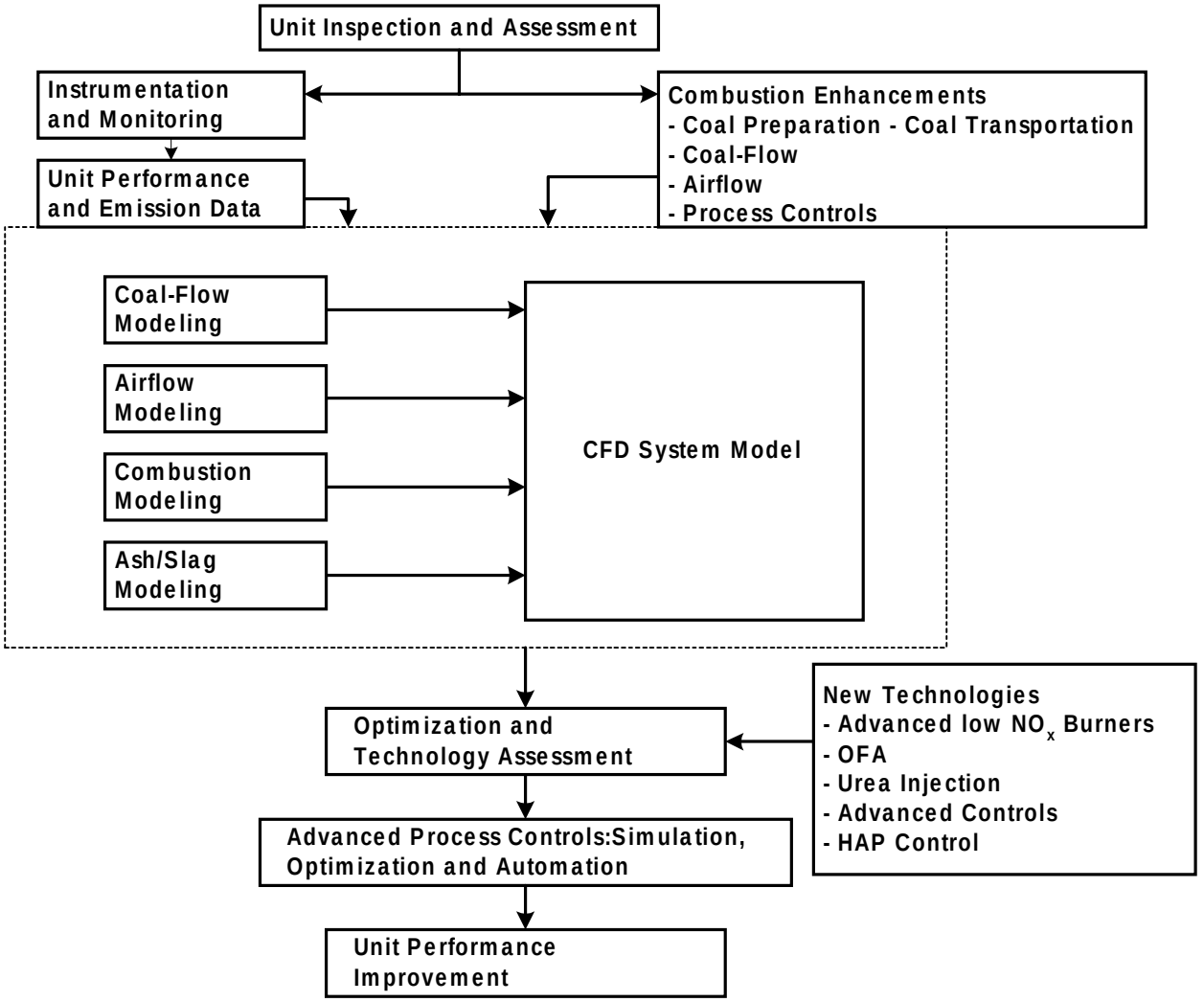
Total Cost: $7.34 MM; DOE Share: $3.67 MM

Project Location: Sheboygan, Wisconsin

Edgewater Generating Station Unit 4

Project Duration: 24 months

Combustion Initiative Methodology



Combustion Initiative
Project Goals & Features

- **Cost effective low-NO_x combustion technology for 340 MWe cyclone-fired boiler**
  - Advanced low-NO_x burners with over-fire air
  - Balance coal/air flows
  - Improve mill performance
  - SNCR (urea injection)
  - Computational fluid dynamic models for plant simulation and optimization
- **Target 0.15lb/MMBtu NO_x**

Achieving NSPS Emission Standards Through Integration of Low-NO_x Burners with an Optimization Plan for Boiler Combustion

Participant: Sunflower Electric Power

Team Members: LNB Vendor, EPRI

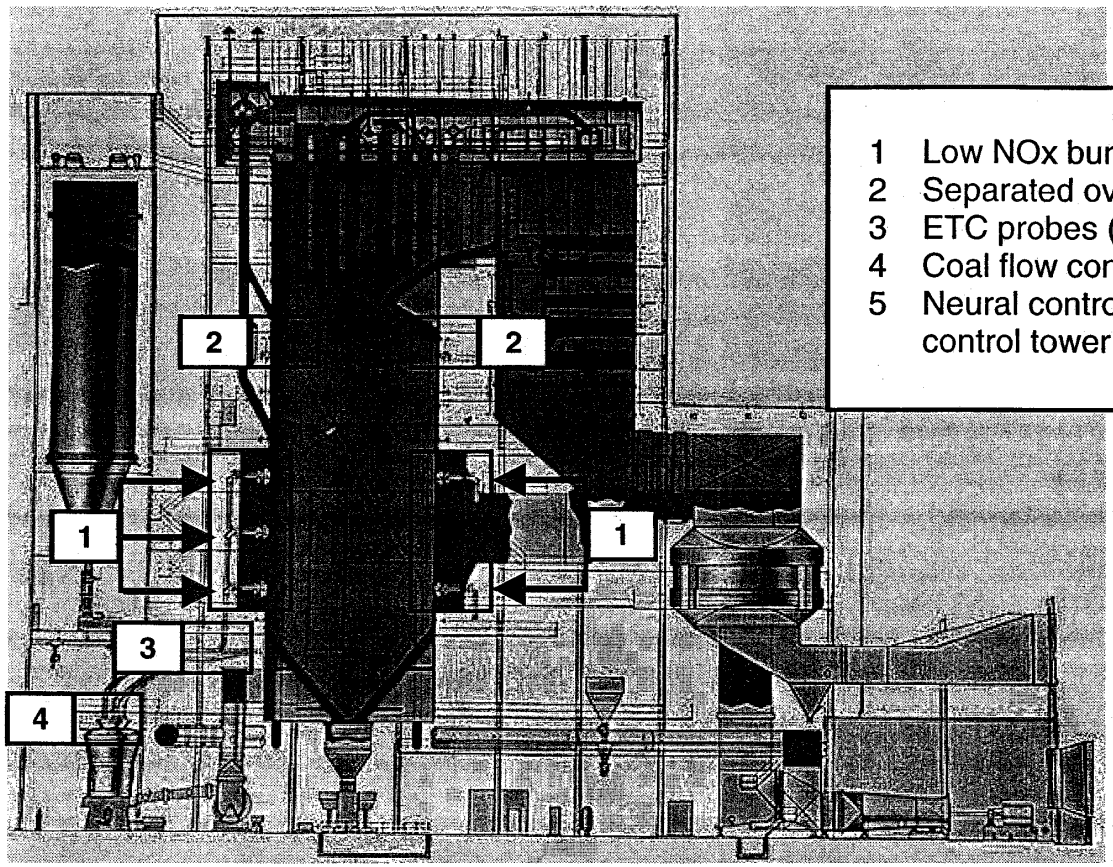
Total Cost: $5.83 MM; DOE Share: $2.79 MM

Project Location: Garden City, Kansas

Holcomb Unit 1

Project Duration: 48 months

Project Schematic



LEGEND

1 Low NOx burners (25 quantity)
2 Separated over-fire with ports (14 quantity)
3 ETC probes (25 quantity)
4 Coal flow controls (25 quantity)
5 Neural controls – not shown (located plant control tower adjacent to boiler room)

Sunflower Low-NO_x Project Goals & Features

- **Demonstrate integrated system on 360 MWe wall-fired boiler using Powder River Basin coal**
  - Ultra low-NO_x burners
  - Separated over-fire air (SOFA)
  - Fuel flow measurement transducers
  - Air balancing
  - Neural network control

- **Target: 0.13-0.14 lb/MMBtu NO_x**

Big Bend Station Neural Network-Sootblower Optimization

Participant: Tampa Electric

Total Cost: $2.38 MM; DOE Share: $0.905 MM

Project Location: Apollo Beach, FL

Project Duration: 36 months

Big Bend Neural Network
Project Goals & Features

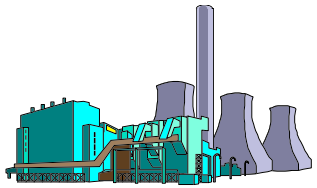
- Develop neural network to modify sootblowing sequence in response to real-time events, in lieu of time or general rule based protocols

- Reduce NO_x by 30% and increase efficiency through more stable FEGT and better temperature distribution

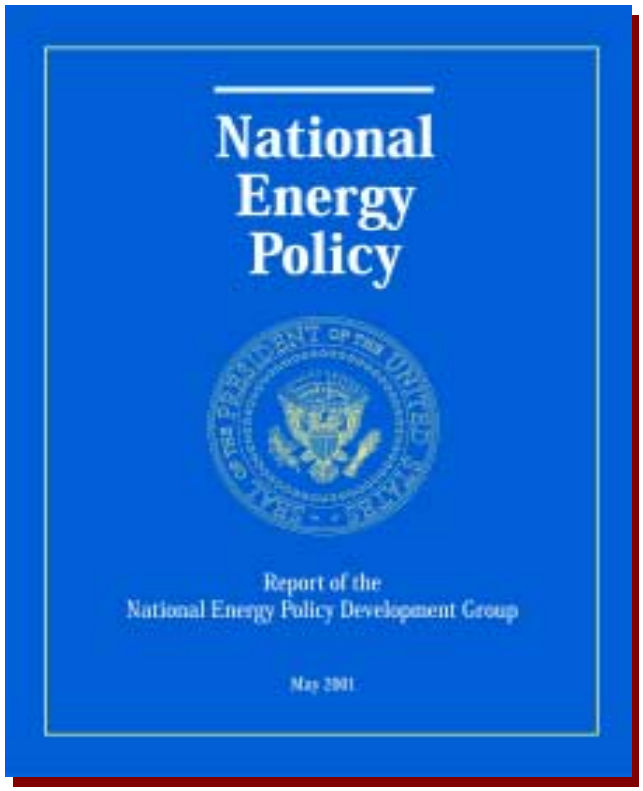
- Reduce PM emissions through reduced UBC, sootblowing coordination with ESP rapping, and more uniform ESP inlet temperatures

Clean Coal Power Initiative (CCPI)

- Cooperative, cost-shared program between government and industry to:
  - Demonstrate emerging technologies in coal-based power generation
  - Accelerate technology deployment to commercial use
- Provides early demonstration opportunities for core coal and power RD&D as precursor to Vision 21



Clean, Reliable & Affordable Electricity for America's Future



CCPI is a key component of the National Energy Policy

CCPI Congressional Language - Key Points

- **"…demonstrations of commercial scale technologies to reduce the barriers to continued and expanded coal use"**
- **"...demonstrate technologies that can strengthen electricity reliability for the Nation in an environmentally clean manner"**
- **Repayment may be different from clean coal approach**
- **Solicitation released - 120 days**
- **Proposal preparation time - 150 days**
- **Project Selections - 160 days**

Differences Between PPII & CCPI

Power Plant Improvement Initiative	Clean Coal Power Initiative
> Firm site required by selection date	> Firm site required by award date
> Firm financing by award date	> Firm financing by end of project definition
> None	> Project definition phase following award for NEPA, financing, etc.
> None	> Project specific development activities (PSDA) limited to 10% of project cost
> Funding = $95 million	> Funding = $300-$400 million
> Proposals due within 90 days	> Proposals due within 150 days
> Hardcopy proposal submittal	> Electronic (soft copy) proposal submittal
> DOE formula for repayment	> Proposer-based repayment plan - scored
> Cash repayment	> Repayment in cash and/or increased up-front cost share
> Repayment period starts at end of demo.	> Repayment period starts during demo.
> None	> Communication plan required
> Public abstract required (no cost info.)	> Public abstract required (including costs)

Evaluation Criteria

Power Plant Improvement Initiative

- > Technical Merit 40%
- > Management Approach & Capabilities 30%
- > Commercial Viability & Market Potential 30%

Clean Coal Power Initiative

- > Technical Merit 50%
- > Project Feasibility 30%
- > Commercial Feasibility 20%

  (including weighting of repayment plan)

CCPI Structure

- **Structure solicitation for anticipated $300 - 400 million**
  - **$30+ million from PPII to be applied to CCPI**
  - **Congressional permission to use anticipated FY03 funding**
- **Include project definition phase**
  - **Provides time and money for proposers to finalize financing and NEPA**
- **Site guarantees required prior to award**
  - **PPII required guaranteed site prior to selection**
- **Allow larger projects**
  - **"DOE expects to make two or more awards from this solicitation…"**
- **Retain coal focus**
  - **75% US-based coal (thermal input)**

CCPI Structure

- **Improve public abstracts**
  - **Require additional information on project costs, schedules, principal entities**
- **Use outside reviewers for technical proposals**
  - **Similar to PPII**
- **Require proposers to submit communication plans**
  - **Include communication language in model agreement**

CCPI Structure

- **NSR waiver**
  - **Projects proposed under CCPI are eligible as "Clean Coal Technology Demonstration Projects" for exemptions from New Source Review (NSR) permitting and New Source Performance Standards (NSPS) if they meet the criteria established in the Clean Air Act and EPA's implementing regulations (40 CFR Parts 51, 52 and 60). States may have their own permitting requirements not controlled by the exemptions.**
  - **Need GC approval and, ultimately, EPA backing to provide any real assurances to proposers**

CCPI Repayment

- Objectives
  - Encourage increased private sector share
  - Provide multiple options for repayment
  - Enhance probability of repayment
  - Better link/integrate commercialization and repayment plans
- Proposer based, less scripted by DOE
- Repayment plan scored as part of commercialization criteria
- Repayment options based on net present value options
  - Sliding scale repayment terms between 50%-74% cost share
  - Full repayment credit above 75% cost share

Repayment Example

- **Hypothetical Example**
  - **$ 40 Million Total Project Cost**
  - **Repayment to begin 5 years after project award**
  - **20 year repayment period**
  - **Full repayment assumed by end of repayment period**
  - **Discount rate assumed at 5.375%**

Project Case	Total Project Cost	Gov't Cost Share %/$	NPV of 20-yr revenue stream	NPV Cost to DOE	Equivalent Gov't /Private Cost Share on NPV basis
1	$40M	25%/ $10M	--------	$10.0M	25%/75%
2	$40M	50%/ $20M	$9.8M	$10.2M	26%/74%

CCPI Program Schedule

ID	Task Name
1	Public Comment Meeting
2	**Prepare Solicitation**
3	Prepare Draft Solicitation
4	Draft Solicitation Issued
5	Public Comment Meeting
6	Prepare Final Solicitation
7	Solicitation Issued
8	**Proposal Preparation**
9	Proposal Preparation
10	Proposals Received
11	**Review and Selection**
12	Technical Evaluation
13	Clarifications
14	Rank Proposals
15	Selections Made